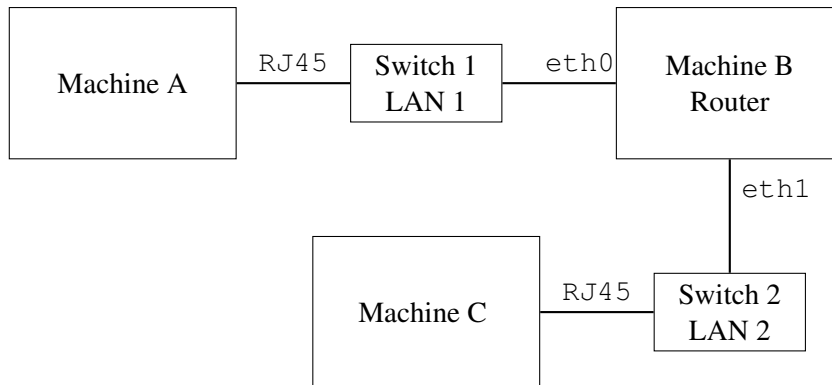


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1. Consider the network depicted in the following figure.



The interface of *Machine A* is configured with the IP address 192.168.1.2/30. A TCP connection is made from the port 5248 of the machine *Machine A* to the web server running on port 80 of the machine *C*. The IP datagrams received at *C* over this TCP connection have the source IP 192.168.1.2 and the source port 5248. The datalink frame containing the IP datagrams of the TCP connection received at *Machine C* has the source MAC address **08:00:27:f9:cf:12** and the destination MAC address **08:00:27:f9:cf:01**. The IP datagrams of the above TCP connection coming to *Machine A* have the source IP address 192.248.17.14. The *eth0* interface of *B* has the MAC address **09:00:27:f9:cf:02**. An ARP request issued for the IP address 192.248.17.1 received a reply with the MAC address **08:00:27:f9:cf:12**.

(a). What is the IP address of the interface *eth0* of *Machine B*? Justify your answer.

[10 marks]

IP addresses of *A* 192.168.1.1/30 and *B* is in the same network. Only two machines can be in a /30 network and the only possible IP address for *eth0* is 192.168.1.1/30

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(b). What is the MAC address of the interface `eth1` of *B*?

Justify your answer.

[10 marks]

**08:00:27:f9:cf:12**

Packets from *A* are forwarded to *C* through the interface `eth1` of *B*. These Ethernet frames have the source MAC address **08:00:27:f9:cf:12**.

(c). What is the IP address assigned to the interface `eth1` of *B*? Justify your answer.

[10 marks]

192.248.17.1

The MAC address of `eth1` is **08:00:27:f9:cf:12** and an ARP request for 192.248.17.1 returned **08:00:27:f9:cf:12**

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(d). What is the IP address of the only network interface of  $C$ ? Justify your answer.

[10 marks]

192.248.17.14.

The IP datagrams of the above TCP connection coming to  $A$  has the source IP address 192.248.17.14.

(e). Does the TCP connection from  $A$  to  $C$  go through a Network Address Translator? Justify your answer.

[10 marks]

No.

The datagrams received at  $C$  has the source IP address of  $A$  and the source port is the same port as the source port at  $A$ .

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2. (a). List down **four (4)** components of the *Transmission Control Protocol (TCP)* header other than the *source port* and the *destination port*.

[4 marks]

sequence number, acknowledgement number, window size, checksum, urgent pointer, options, TCP header length, Flags — any 4 from the above. Topic 5, page 39, references page 557

- (b). Describe the process of connection release in *Transmission Control Protocol (TCP)*.

[14 marks]

One party can send a FIN bit set, saying that there is no data to be sent. When the FIN is acknowledged, that direction is shut down for new data. But data can flow in the other direction. When both directions are shutdown, the connection is closed. TCP need four segments to release a connection. One FIN and one ACK in each direction. Topic 5 - page 45

FIN piggybacking, if the sender has a final piece of data to send before closing, it can include that data in the same TCP segment that has the FIN flag set. This means instead of sending a data segment followed by a separate FIN segment, it sends a single segment containing both the last data and the indication to close the connection.

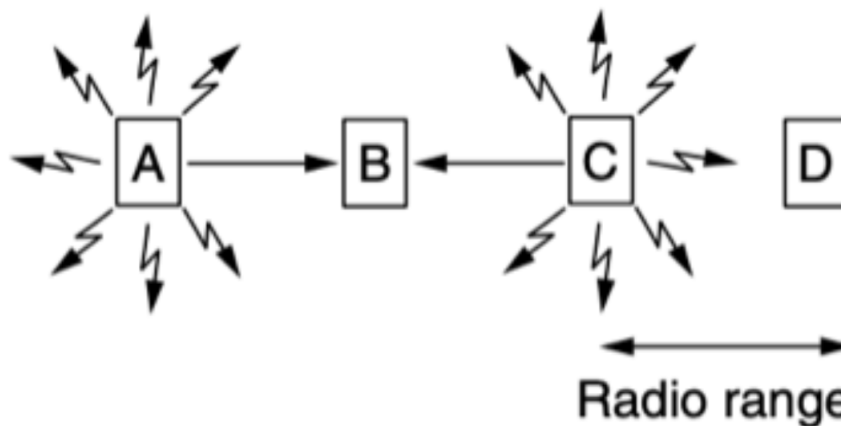
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- (c). Explain the *hidden terminal problem* in wireless networks by illustrating the phenomenon using a suitable diagram.

[12 marks]

A and C want to transmit to B. But C is not within the range of A. Therefore, if A is transmitting, C cannot sense it, though it senses the medium. If C start transmission, collisions may occur at B.

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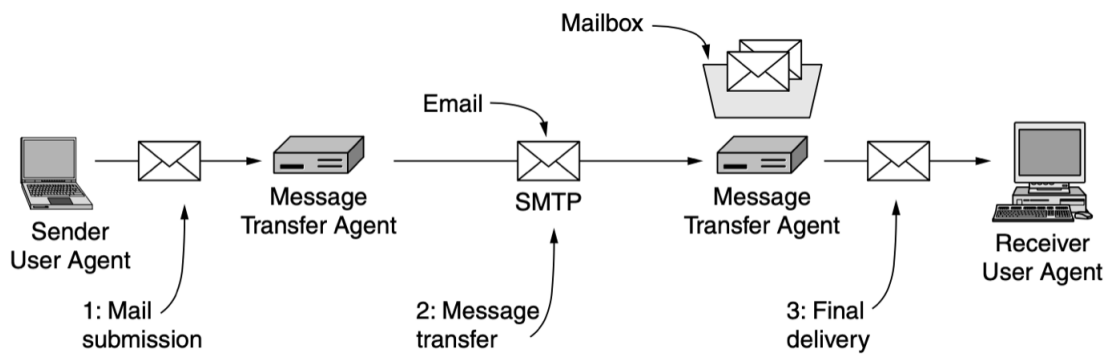
- (d). What is a **Virtual LAN (VLAN)**?

[8 marks]

VLAN is a logical grouping of network devices that allows for segmenting a physical Local Area Network (LAN) into multiple distinct broadcast domains. This segmentation is done at the data link layer (Layer 2) of the OSI model. Topic 3 Page 58

- (e). Illustrate the architecture of the email system using a diagram by including all the necessary components.

[12 marks]



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